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Indian Standard

SPECIFICATION FOR ALTERNATING CURRENT DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES FOR VOLTAGES ABOVE 1 000 V

PART II RATING

(Second Reprint DECEMBER 1991)

UDC 621·316·545·025 : 621·3·02

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NEW DELHI 110002

Gr 7 *September* 1982

Indian Standard
SPECIFICATION FOR ALTERNATING CURRENT DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES FOR VOLTAGES ABOVE 1 000 V

PART II RATING

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Indian Standard
SPECIFICATION FOR ALTERNATING CURRENT DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES FOR VOLTAGES ABOVE 1 000 V

PART II RATING

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 28 June 1982, after the draft finalized by the High Voltage Switchgear and Controlgear Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 With the large scale manufacture of air-break isolators in the country, the need for specifying uniform requirements for such equipment was felt, particularly in view of different practices being followed by the manufacturers because of their tie-ups with different overseas manufacturers. This standard was therefore, originally prepared as IS : 1818 in 1961 to meet this need and to provide guidance to the new manufacturers in this field.

0.3 The first revision of IS : 1818 was brought out in 1972, mainly for the purposes of taking into account the developments at the international level and expanding the scope to cover ratings up to 420 kV. The revision, in comparison to the original version, also covered oil-break type isolators and earthing switches; the latter is considered similar in operation to the former. In making the revision however, it was recognized that when both the isolators and earthing switches are combined in one unit, an interlock is needed to be provided to ensure proper operation and safety.

0.4 The last few years in the history of development of high voltage switchgear had seen considerable advancement in knowhow on the performance of the equipment and the associated stipulations that are to be precisely made in the national standards. Considerable modifications therefore, became necessary in the specifications on circuit-breakers, switches, fuses, etc, in order to keep pace with the international thinking on the subject.

0.5 The present version of the standard on this subject is therefore, being brought out to incorporate the latest in technology as is also recognized in international publications. For the purposes of clarity, this version is brought out in five parts. The other parts are:

Part I	General and definitions;
Part III	Design and construction;
Part IV	Type tests and routine tests ; and
Part V	Information to be given with tenders, enquiries and orders and rules for selection, transport, erection and maintenance (*under consideration*).

All parts shall be read in conjunction with one another. This standard (Part II) which deals with the rating of equipment partly replaces IS : 1818-1972*. All the parts in the series together will replace IS : 1818, completely.

0.6 While preparing this standard, assistance has been derived from IEC Pub 129-1975 'Alternating current disconnectors (isolators) and earthing switches' issued by the International Electrotechnical Commission.

0.7 In order to facilitate comparison with the International standards and for ease of reference, the committee has decided to add in the form of an appendix, the major differences between this Indian Standard and the corresponding IEC Publication (*see* Appendix A).

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value. observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part II) covers the rated characteristics of alternating current disconnectors and earthing switches designed for indoor and outdoor installation for voltages above 1 000 V ac and for the service frequency of 50 Hz.

NOTE — For detailed scope of this series of standards on high voltage alternating current isolators and earthing switches, *see* **1** of Part I of this standard.

2. TERMINOLOGY

2.1 For the purposes of this standard, the definitions given in **4** of Part I of this standard shall apply.

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*Alternating current isolators (disconnectors) and earthing switches (*first revision*).

†Rules for rounding off numerical values (*revised*).

3. RATED CHARACTERISTICS

3.0 The characteristics of a disconnector or earthing switch, including its operating devices and auxiliary equipment, that shall be used to determine the rating, shall be those given below:

a) Rated voltage;
b) Rated insulation level;
c) Rated frequency;
d) Rated normal current (for disconnectors only);
e) Rated short-time withstand current;
f) Rated duration of short circuit;
g) Rated peak withstand current;
h) Rated short-circuit making current (for earthing switches only);
j) Rated contact zone;
k) Rated mechanical terminal load;
m) Rated supply voltage of closing and opening devices (where these operating devices are supplied separately), of auxiliary circuits, peak power and total durations of operations;
n) Rated supply frequency of closing and opening devices and of auxiliary circuits;
p) Rated pressure of compressed gas supply for operation; and
q) Rated values of maximum force required for manual operation (*under consideration*).

3.1 Rated Voltage

3.1.1 The rated voltage of a disconnector or earthing switch is a voltage value which is used to designate it and to which some of its characteristics are related. The rated voltage of a disconnector or earthing switch indicates the upper limit of the highest voltage of systems for which the disconnector or earthing switch is intended (*see* IS : 585-1962*).

3.1.2 The rated voltage of a three-pole disconnector or earthing switch shall be selected from the list of standard values given below:

3.1.2.1 *For rated voltages of 72·5 kV and below:*

3·6, 7·2, 12, 24, 36, 52, or 72·5 kV

3.1.2.2 *For rated voltages above 72·5 kV:*

123, 145, 245, or 420 kV

---

*Voltages and frequency for ac transmission and distribution systems (*revised*).

3.2 Rated Insulation Level

3.2.0 The rated insulation level of a disconnector or earthing switch shall be selected from the values given in Tables 1, 2, or 3.

The withstand voltage values in Tables 1, 2 and 3 apply at the standard reference atmosphere (temperature, pressure and humidity) specified in IS : 2071 (Part I)-1974*.

3.2.1 *Rated Voltages up to and Including 72·5 kV* — The insulation levels for rated voltages up to and including 72·5 kV are given in Table 1.

TABLE 1 INSULATION LEVELS FOR RATED VOLTAGES UP TO AND INCLUDING 72·5 kV

(*Clauses* 3.2.0 *and* 3.2.1)

RATED VOLTAGE U_n kV (rms)	RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE U_w				RATED ONE-MINUTE POWER-FREQUENCY WITHSTAND VOLTAGE	
	List 1 kV (peak)		List 2 kV (peak)		kV (rms)	
	To earth and between poles	Across the isolating distance	To earth and between poles	Across the isolating distance	To earth and between poles	Across the isolating distance
(1)	(2)	(3)	(4)	(5)	(6)	(7)
3·6	20	23	40	46	10	12
7·2	40	46	60	70	20	23
12	60	70	75	85	28	32
24	95	110	125	145	50	60
36	145	165	170	195	70	80
52	250	290	250	290	95	110
72·5	325	375	325	375	140	160

3.2.1.1 The choice between Lists 1 and 2 should be made by considering the degree of exposure to lightning, switching overvoltages, the type of system neutral earthing and, where applicable, the type of overvoltage protective device.

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*Methods of high voltage testing: Part I General definitions and test requirements (*first revision*).

3.2.1.2 Equipment designed to List 1 is suitable for installations such as the following:

a) In systems and industrial installations not connected to overhead lines:

  1) Where the system neutral is earthed either solidly or through an impedance which is low compared with that of an arc-suppression coil. Surge protective devices, such as diverters, are generally not required;

  2) Where the system neutral is earthed through an arc-suppression coil and adequate overvoltage protection is provided in special system, for example, an extensive cable network, where surge diverters capable of discharging the cable capacitance may be required.

b) In systems and industrial installations connected to overhead lines only through transformers where cables or additional capacitors of at least 0·05 μF per phase are connected between the transformer lower-voltage terminals and earth, on the transformer side of the switchgear and as close as possible to the transformer terminals. This covers the following cases:

  1) Where the system neutral is earthed either solidly or through a coil whose impedance is low compared with that of an arc-suppression coil. Overvoltage protection by means of surge diverters may be desirable;

  2) Where the system neutral is earthed through an arc-suppression coil and where adequate overvoltage protection is provided by surge diverters.

c) In systems and industrial installations connected directly to overhead lines:

  1) Where the system neutral is earthed either solidly or through a coil whose impedance is low compared with that of an arc-suppression coil and where adequate overvoltage protection by spark gaps or surge diverters is provided depending on the probability of overvoltage amplitude and frequency;

  2) Where the system neutral is earthed through an arc-suppression coil and where adequate overvoltage protection is provided by surge diverters.

3.2.1.3 In all other cases, or where a very high degree of security is required, equipment designed to List 2 has to be used.

3.2.2 *Rated Voltages from 123 kV to 245 kV* — The voltages shall be selected from values given in Table 2 using lightning impulse withstand voltage and power-frequency withstand voltage values of the same line.

For the choice between the alternative values for the same rated voltage, *see* IS : 2165-1977*.

TABLE 2 INSULATION LEVELS FOR RATED VOLTAGES EQUAL TO AND ABOVE 123 kV BUT BELOW 420 kW

(*Clauses* 3.2.0 *and* 3.2.2)

RATED VOLTAGE U_n kV (rms)	RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE kV (peak)		RATED ONE-MINUTE POWER-FREQUENCY WITHSTAND VOLTAGE kV (rms)	
	To earth and between poles	Across the isolating distance	To earth and between poles	Across the isolating distance
(1)	(2)	(3)	(4)	(5)
123	450	520	185	210
	550	630	230	265
145	550	630	230	265
	650	750	275	315
245	850	950	360	415
	950	1 050	395	460
	1 050	1 200	460	530

3.2.3 *Rated Voltages Above 245 kV* — The voltages shall be selected from values of Table 3 using lightning impulse withstand voltage and switching impulse withstand voltage values of the same line.

For the choice between the alternative values for the same voltage, *see* IS : 2165-1977*.

TABLE 3 INSULATION LEVELS FOR RATED VOLTAGES FOR EQUAL TO 420 kV

(*Clauses* 3.2.0 *and* 3.2.3)

RATED VOLTAGE U_n kV (rms)	RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE kV (peak)		RATED SWITCHING IMPULSE WITHSTAND VOLTAGE kV (peak)		
	To earth	Across the isolating distance	To earth	Across the isolating distance	
(1)	(2)	(3) *	(4)	(5) Class A†	(6) Class B†
420	1 300	1 300 (+ 205)	950	1 050	900 (+ 345)
	1 425	1 425 (+ 205)	1 050		

**See* Part IV of this standard, values in brackets are the peak values of the power-frequency voltage applied to the opposite terminal.

†*See* Part IV of this standard, values in brackets for column (6), are the peak values of the power-frequency voltage applied to the opposite terminal.

---

*Specification for insulation co-ordination (*second revision*).

3.3 Rated Frequency

3.3.1 The rated frequency of a disconnector or earthing switch is the power frequency for which the disconnector or earthing switch is designed and to which the other rated characteristics correspond. The standard value of rated frequency shall be 50 Hz.

3.4 Rated Normal Current

3.4.1 The rated normal current of a disconnector is the rms value of the current which the disconnector shall be able to carry continuously without deterioration at its rated frequency with the temperature rises of the various parts not exceeding the values specified in Table 4.

3.4.2 The values of rated normal current (in A) shall be selected from the following standard values:

200. 400, 630, 800. 1 250, 1 600, 2 000, 2 500, 3 150, 4 000. 5 000, or 6 300.

NOTE — The above values are selected from the R 10 series, and, if required, higher values than those shown should also be selected from this series.

3.5 Rated Duration in Short-Circuit

3.5.1 The rated duration of short circuit of a disconnector or earthing switch is that period of time for which it can carry, when closed, a current equal to its rated short-time withstand current.

3.5.2 The standard value of rated duration of short circuit is 1 s. If a value of more than 1 s is necessary, the value of 3 s is recommended.

3.6 Rated Short-Time Withstand Current

3.6.1 The rms value of the rated short-time withstand current (in kA) of a disconnector or earthing switch shall be selected from the following standard values:

8, 10, 12·5, 16, 20, 25, 31·5, 40, 50, 63, 80, or 100 kA.

3.6.2 If an earthing switch is combined with a disconnector as a single unit, the rated short-time withstand current of the earthing switch shall, unless otherwise specified, be at least equal to that assigned to the disconnector.

3.7 Rated Peak Withstand Current

3.7.1 The rated peak withstand current of a disconnector or earthing switch is that peak current which it shall be able to carry in the closed position without material deterioration. The standard value of the rated peak withstand current shall be equal to 2·5 times the rated, short-time withstand current.

3.7.2 If an earthing switch is combined with a disconnector as a single unit, the rated peak withstand current of the earthing switch shall, unless otherwise specified, be at least equal to that assigned to the disconnector.

3.8 Rated Short-Circuit-Making Current

3.8.1 Earthing switches to which a rated short-circuit-making current has been assigned shall be capable of making at any applied voltage, up to and including that corresponding to their rated voltage, any current up to and including their rated short-circuit-making current.

3.8.2 If an earthing switch has a rated short-circuit-making current, this shall be equal to the rated peak withstand current.

3.9 Temperature Rise

3.9.1 The temperature rise of any part of a disconnector shall not exceed the maximum temperature rise specified in Table 4 under the conditions specified in the test clauses in Part IV of this standard.

3.10 Rated Contact Zone

3.10.1 Divided frame disconnectors and earthing switches shall be able to operate within the limits of their rated contact zone. The manufacturer shall state the values of maximum and minimum mechanical reaction forces and the method of fixing the fixed contact required in case these forces are relevant to the satisfactory operating conditions of the disconnector or earthing switch.

3.10.2 Examples of rated contact zones of disconnectors and earthing switches having fixed contact pieces supported by flexible conductors are illustrated in Fig. 1 and 2, and given in Table 5.

3.10.3 Examples of rated contact zones of disconnectors and earthing swithes having fixed contacts supported by rigid conductors are given in Table 6 and in Fig. 3.

3.11 Rated Mechanical Terminal Loads

3.11.1 Disconnectors and earthing switches should be able to close and open whilst subject to their rated mechanical terminal loads, where assigned, plus wind loads acting on the equipment itself.

NOTE — Wind loads on outdoor equipment and conductors are of a variable nature and are increased by the presence of ice or hoar frost. Methods of proving that wind loads will not endanger the equipment are under consideration.

3.11.2 Rated mechanical terminal loads need not be assigned to disconnectors and earthing switches which are not intended to be subject to substantial mechanical terminal loads.

TABLE 4 TEMPERATURE RISE LIMITS

(*Clauses* 3.4.1, 3.9.1 *and* 4.1.1)

Sl No.	Nature of the Part or of the Liquid	Maximum Values of	
		Temperature	Temperature Rise at an Ambient Air Temperature not Exceeding 40°C
		°C	°C
	(1)	(2)	(3)
i)	**Contacts in air:**		
	a) Silver-faced copper, copper alloy or aluminium alloy (*see* Notes 1 and 2)	105	65
	b) Bare copper or tinned aluminium alloy	75	35
ii)	**Contacts in oil:**		
	a) Silver-faced copper, copper alloy or aluminium alloy (*see* Note 2)	90	50
	b) Bare copper or tinned aluminium alloy	80	40
iii)	**Terminals of disconnectors to be connected to external conductors by screws or bolts:**		
	a) Silver-faced (*see* Note 3)	105	65
	b) Bare	90	50
iv)	Metal parts acting as springs	(*see* Note 4)	(*see* Note 4)
v)	**Metal parts in contact with isulation of the following classes (*see* Note 5):**		
	a) Class Y (for non-impregnated materials)	90	50
	b) Class A (for materials immersed in oil or impregnated)	100	60
	c) Class E		
	in air	120	80
	in oil	100	60
	d) Class B		
	in air	130	90
	in oil	100	60
	e) Class F		
	in air	155	115
	in oil	100	60
	f) Enamel		
	oil base	100	60
	synthetic, in air	120	80
	synthetic, in oil	100	60
vi)	Any part of metal or of insulating material in contact with oil, except contacts	100	60
vii)	Oil for oil-immersed disconnectors and earthing switches (*see* Note 6)	90	50

(*Continued*)

TABLE 4 TEMPERATURE RISE LIMITS — *Contd*

NOTE 1 — When applying the temperature rise of 65°C care should be taken to ensure that no damage is caused to the surrounding insulating materials.

NOTE 2 — The quality of the silver facing shall be such that a layer of silver remains at the points of contact after the mechanical endurance test. Otherwise, the contacts shall be regarded as bare.

NOTE 3 — The values of temperature and temperature rise are valid whether or not the conductor connected to the terminals is silver-faced.

NOTE 4 — The temperature shall not reach a value where the elasticity of the materials is impared. For pure copper, this implies a temperature limit of 75°C.

NOTE 5 — The following classes of insulating materials are used:

Class Y

Insulation consists of materials or combinations of materials such as cotton, silk and paper without impregnation. Other materials or combinations of materials may be included in this class if, by experience or accepted tests, they can be shown to be capable of operation at Class Y temperatures.

Class A

Insulation consists of materials or combinations of materials such as cotton, silk and paper; when suitably impregnated, coated, or when immersed in a dielectric liquid such as oil. Other materials or combinations of materials may be included in this class if, by experience or accepted tests, they can be shown to be capable of operational at Class A temperatures.

Class E

Insulation consists of materials or combinations of materials which, by experience or accepted tests, can be shown to be capable of operation at Class E temperatures.

Class B

Insulation consists of materials or combinations of materials such as mica, glass fibre, asbestos, etc, with suitable bonding substances, as well as other materials or combinations of materials, not necessarily inorganic, which by experience or accepted tests, can be shown to be capable of operation at Class F temperature.

NOTE 6 — Special consideration should be given when low-flash-point oil is used in regard to vaporization and oxidation.

NOTE 7 — When other materials than those mentioned in Table 4 are used, the nature and quality of these materials shall be considered.

NOTE 8 — The limits for temperature rise of contacts in vacuum, gases other than air and liquids other than oil are under consideration.

NOTE 9 — Special care must be taken when using silver-faced aluminium contacts in a corrosive atmosphere in outdoor installations.

TABLE 5 EXAMPLES OF RATED CONTACT ZONES FOR 'FIXED' CONTACT PIECES SUPPORTED BY FLEXIBLE CONDUCTORS

(*Clause* 3.10.2)

Rated Voltage	*L*	*S*	*U*
(1)	(2)	(3)	(4)
kV	(m)	(m)	(m)
72·5	0·30	0·20	0·20
123	0·35	0·20	0·25
145	0·35	0·20	0·25
245	0·50	0·25	0·30
420	0·50	0·30	0·40

where

L = horizontal deflection,

S = vertical deflection, and

U = total amplitude of longitudinal movement with respect to supporting conductor.

TABLE 6 EXAMPLES OF RATED CONTACT ZONES FOR 'FIXED' CONTACT PIECES SUPPORTED BY RIGID CONDUCTORS

(*Clause* 3.10.3)

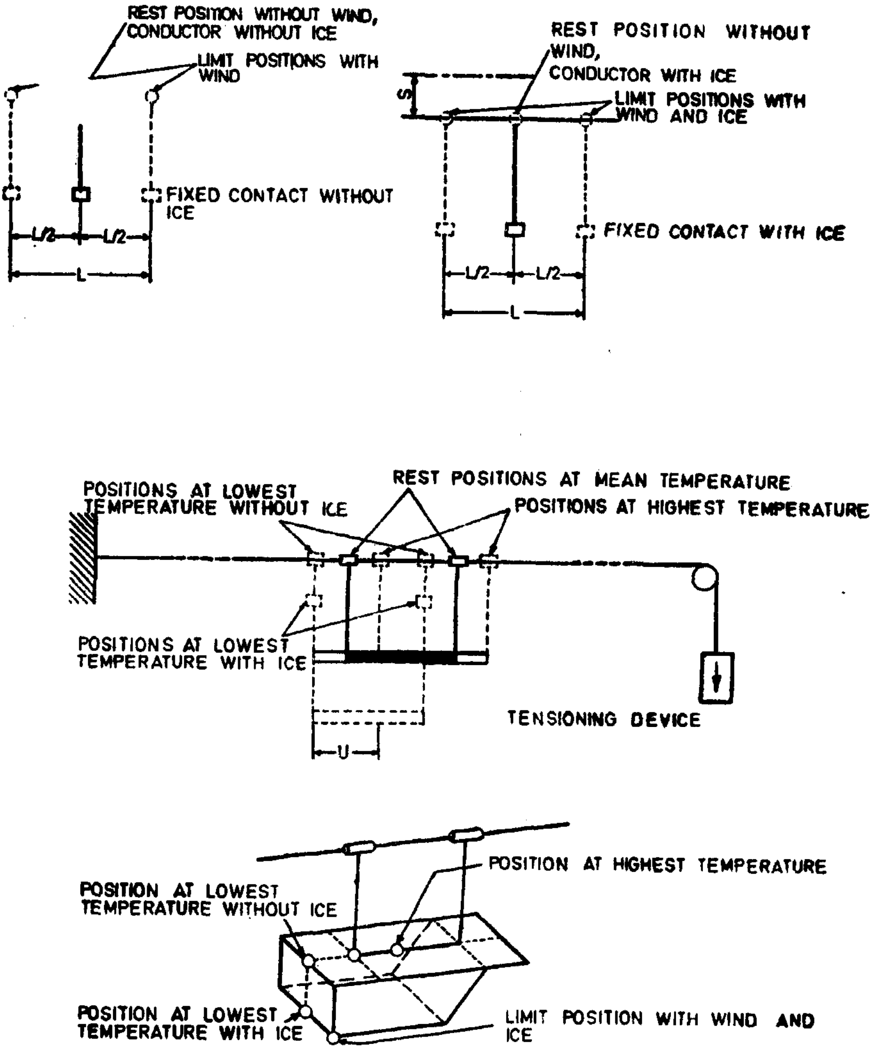
Rated Voltage	*L*	*S*	*U*
(1)	(2)	(3)	(4)
kV	(m)	(m)	(m)
72·5	0·10	0·10	0·10
123	0·10	0·10	0·10
145	0·10	0·10	0·10
245	0·15	0·15	0·20
420	0·15	0·15	0·20

where

L = horizontal deflection,

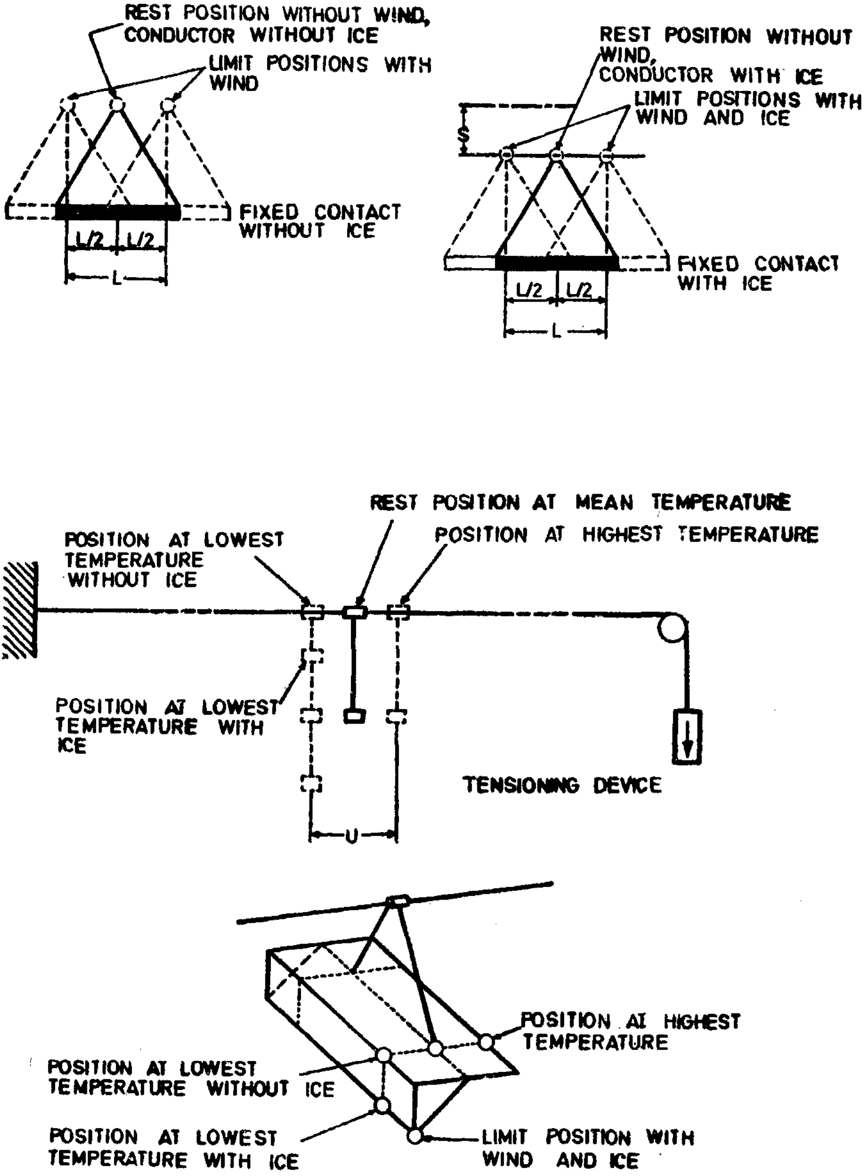
S = vertical deflection, and

U = total amplitude of longitudinal movement with respect to supporting conductor.


REST POSITION WITHOUT WIND, CONDUCTOR WITHOUT ICE
LIMIT POSITIONS WITH WIND
FIXED CONTACT WITHOUT ICE
L/2
L/2
L
REST POSITION WITHOUT WIND, CONDUCTOR WITH ICE
S
LIMIT POSITIONS WITH WIND AND ICE
FIXED CONTACT WITH ICE
L/2
L/2
L
POSITIONS AT LOWEST TEMPERATURE WITHOUT ICE
REST POSITIONS AT MEAN TEMPERATURE
POSITIONS AT HIGHEST TEMPERATURE
POSITIONS AT LOWEST TEMPERATURE WITH ICE
TENSIONING DEVICE
U
POSITION AT HIGHEST TEMPERATURE
POSITION AT LOWEST TEMPERATURE WITHOUT ICE
POSITION AT LOWEST TEMPERATURE WITH ICE
LIMIT POSITION WITH WIND AND ICE

RATED CONTACT ZONE

FIG. 1 FIXED CONTACT PIECE PARALLEL TO THE SUPPORTING CONDUCTOR


REST POSITION WITHOUT WIND, CONDUCTOR WITHOUT ICE
LIMIT POSITIONS WITH WIND
FIXED CONTACT WITHOUT ICE
L/2
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REST POSITION WITHOUT WIND, CONDUCTOR WITH ICE
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S
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REST POSITION AT MEAN TEMPERATURE
POSITION AT LOWEST TEMPERATURE WITHOUT ICE
POSITION AT HIGHEST TEMPERATURE
POSITION AT LOWEST TEMPERATURE WITH ICE
TENSIONING DEVICE
U
POSITION AT HIGHEST TEMPERATURE
POSITION AT LOWEST TEMPERATURE WITHOUT ICE
POSITION AT LOWEST TEMPERATURE WITH ICE
LIMIT POSITION WITH WIND AND ICE

RATED CONTACT ZONE

FIG. 2 FIXED CONTACT PIECE PERPENDICULAR TO THE SUPPORTING CONDUCTOR

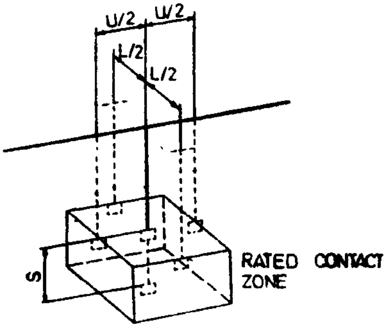

FIG. 3 CASE OF RIGID CONDUCTORS

3.11.3 Some examples of rated mechanical terminal loads (not including wind forces on the equipment itself) are given in Table 7 and are intended to be used as a guide.

NOTE — In addition to the mechanical terminal loads specified in Table 7, special design precautions shall be taken to account for short-circuit and other forces.

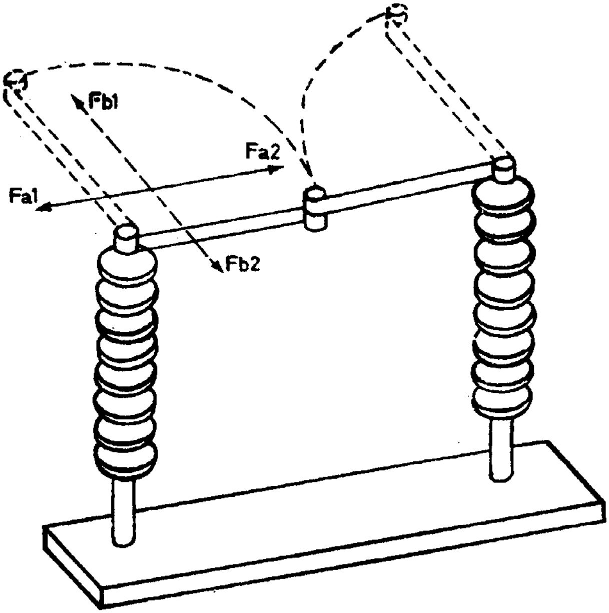

FIG. 4 EXAMPLE OF THE APPLICATION RATED MECHANICAL TERMINAL LOADS TO A TWO-COLUMN DISCONNECTOR

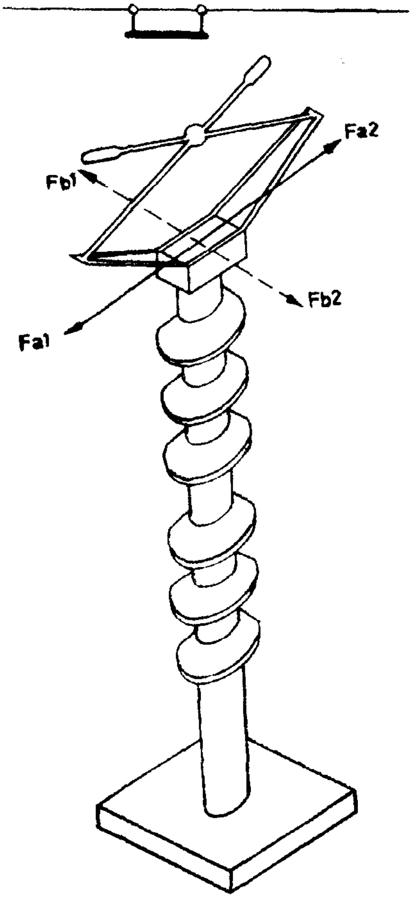

FIG. 5 EXAMPLE OF THE APPLICATION OF RATED MECHANICAL TERMINAL LOADS TO A PANTOGRAPH DISCONNECTOR

3.12 Rated Supply Voltage of Closing and Opening Devices and/or Auxiliary Circuits

3.12.1 The rated supply voltage of closing and opening devices and/or auxiliary circuits is the supply voltage which determines the conditions of operation and of heating, as well as the insulation of the control and/or auxiliary circuits. The supply voltage of these devices shall be understood to mean the voltage measured at the circuit terminals of the apparatus itself during its operation, including the auxiliary resistors or accessories supplied or required by the manufacturer to be installed in series with it, but not including the conductors for the connection to the electricity supply.

TABLE 7 EXAMPLES OF RATED MECHANICAL TERMINAL LOADS

(*Clause* 3.11.3)

RATED VOLTAGE	RATED NORMAL CURRENT	TWO AND THREE-COLUMN DISCONNECTORS (*see* Fig. 4)		DIVIDED SUPPORT DISCONNECTORS (*see* Fig. 5)	
		Straight Load F_{a1} and F_{a2}	Cross-Load F_{b1} and F_{b2}	Straight Load F_{a1} and F_{a2}	Cross-Load F_{b1} and F_{b2}
(1)	(2)	(3)	(4)	(5)	(6)
kV	A	N	N	N	N
72·5	800-1 250	400	130	800	200
123-145	1 250	500	170	800	200
245	800-1 250	800	270	1 250	400
	2 000	1 000	330	1 600	500
420	2 000	1 600	530	2 000	800
	4 000	2 000	660	4 000	1 600

3.12.2 The rated supply voltage shall preferably have one of the appropriate standard values given in Tables 8, 9 and 10. The operating device shall be capable of closing and opening the disconnector or earthing switch for any value of supply voltage between 85 percent and 110 percent of the rated value.

TABLE 8 DIRECT CURRENT

V
24
48
110
220

TABLE 9 SINGLE-PHASE ac

(*Clause* 3.12.2)

V
110
240

NOTE — It refers to two-wire systems.

TABLE 10 THREE-PHASE ac

(*Clause* 3.12.2)

V
240/415

NOTE — The two values indicated refer to four-wire systems and the lower value is the voltage between phases and neutral, the higher value being the voltage between phases.

3.13 Rated Supply Frequency of Operating Devices of Auxiliary Circuits

3.13.1 The rated supply frequency of an operating device or an auxiliary circuit is the frequency at which the conditions of operation and heating are determined.

3.14 Rated Pressure of Compressed Gas Supply for Operation

3.14.1 The rated pressure of a compressed gas supply for a pneumatic operating device is the pressure above atmospheric pressure at which the operating conditions are determined.

3.14.2 Preferred rated pressure are:

500, 1 000, 1 600, 2 000, or 3 000 kPa.

3.14.3 The pneumatic operating device shall be capable of opening and closing the disconnector or earthing switch when the compressed gas pressure is between 85 percent and 105 percent of the rated pressure.

4. BEHAVIOUR WHEN CARRYING RATED PEAK WITHSTAND CURRENT AND RATED SHORT-TIME WITHSTAND CURRENT

4.1 The rated peak withstand current and the rated short-time withstand current, carried by a disconnector in the closed position during the rated duration of short-circuit, shall not cause:

a) Material mechanical damage to any part of the disconnector;

b) Separation of the contacts; and

c) A temperature rise that, added to the maximum temperature obtained when carrying the rated normal current continuously, is likely to damage the insulation.

4.1.1 After the passage of these currents, the disconnector shall be able to carry its rated normal current without its temperature rise exceeding the values specified in Table 4 and shall be capable of operating under conditions specified in **3.12** to **3.14**.

4.2 The rated peak withstand current and the rated short-time withstand current, carried by an earthing switch in the closed position during the rated duration of short-circuit, shall not cause:

a) Material mechanical damage to any part of the earthing switch;

b) Separation of the contacts or substantial contact welding; and

c) A temperature rise likely to damage the insulation.

NOTE — Only light welding of contacts is permitted provided the earthing switch can be operated under the conditions given in Part IV of this standard.

5. BEHAVIOUR OF EARTHING SWITCHES WHEN MAKING SHORT-CIRCUIT CURRENTS

5.1 Earthing switches having a rated short-circuit-making current shall, when making short circuit, comply with the following conditions of behaviour:

a) During operation, the earthing switch shall neither show signs of excessive distress nor endanger the operator.

From liquid-filled earthing switches, there shall be no outward emission of flame, and the gases produced, together with the liquid carried with the gases, shall be allowed to escape in such a way as not to cause electrical breakdown.

For other types of earthing switches, flame or metallic particles which might impair the insulation level of the earthing switch shall not be projected beyond the boundaries specified by the manufacturer.

b) After performing operations corresponding to those specified in Part IV, the mechanical parts and insulators of the earthing switch shall be practically in the same condition as before. The short-circuit making performance may be materially impaired.

c) It is understood that after performing operations corresponding to those specified in Part IV, it may be necessary to carry out inspection of, and maintenance work on, the earthing switch in order to restore it to its original conditions specified by the manufacturer before putting it back into service. For example, the following may be necessary:

1) Repair or replacement of the arc contacts or any other specified renewable parts;

2) Renewal or filtration of the oil, or of any other liquid insulating medium in liquid-filled earthing switches and the addition of any quantity of the medium necessary to restore its normal level; and

3) Removal from the insulators of deposits caused by the decomposition of the liquid insulating medium.

NOTE — Light welding of contacts is permitted provided the earthing switch can be operated under the conditions given in Part IV of this standard, with the 100 percent rated value of pressure and supply voltage.

6. CO-ORDINATION OF RATED VOLTAGES, RATED NORMAL CURRENTS, RATED SHORT-TIME WITHSTAND CURRENTS AND RATED PEAK WITHSTAND CURRENTS

6.1 The co-ordination of the above characteristics is given in Tables 11 and 12.

NOTE — The co-ordination table is intended to be used as a guide for preferred values and is not mandatory. Therefore, a disconnector or earthing switch with another combination of the rated values is not outside this specification. A reduction of the number of preferred combinations of rated values shown in the table is under consideration.

TABLE 11 CO-ORDINATION OF RATED VALUES FOR RATED VOLTAGES 3·6 kV TO 72·5 kV

(*Clause* 6.1)

Rated Voltage kV	Rated Short-Time Withstand Current kA (rms)	Rated Peak Withstand Current kA	Rated Normal Current A (rms)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3·6	10	25	400	—	—	—	—	—	—	—
	16	40	—	630	—	1 250	—	—	—	—
	25	63	—	—	—	1 250	1 600	—	2 500	—
	40	100	—	—	—	1 250	1 600	—	2 500	4 000
7·2	8	20	400	—	—	—	—	—	—	—
	12·5	32	400	630	—	1 250	1 600	—	—	—
	16	40	—	630	—	1 250	1 600	—	—	—
	25	63	—	630	—	1 250	1 600	—	2 500	—
	40	100	—	—	—	1 250	1 600	—	2 500	4 000
12	8	20	400	—	—	—	—	—	—	—
	12·5	32	400	630	—	1 250	—	—	—	—
	16	40	—	630	—	1 250	1 600	—	—	—
	25	63	—	630	—	1 250	1 600	—	2 500	—
	40	100	—	—	—	1 250	1 600	—	2 500	4 000
	50	125	—	—	—	1 250	1 600	—	2 500	4 000

24	8	20	400	630	—	1 250	—	—	—	—
	12·5	32	—	630	—	1 250	—	—	—	—
	16	40	—	630	—	1 250	—	—	—	—
	25	63	—	—	—	1 250	1 600	—	2 500	—
	40	100	—	—	—	—	1 600	—	2 500	4 000
36	8	20	—	630	—	—	—	—	—	—
	12·5	32	—	630	—	1 250	—	—	—	—
	16	40	—	630	—	1 250	1 600	—	—	—
	25	63	—	—	—	1 250	1 600	—	2 500	—
	40	100	—	—	—	—	1 600	—	2 500	4 000
52	8	20	—	—	800	—	—	—	—	—
	12·5	32	—	—	—	1 250	—	—	—	—
	20	50	—	—	—	1 250	1 600	2 000	—	—
72·5	12·5	32	—	—	800	1 250	—	—	—	—
	16	40	—	—	800	1 250	—	—	—	—
	20	50	—	—	—	1 250	1 600	2 000	—	—
	31·5	80	—	—	—	1 250	1 600	2 000	—	—

TABLE 12 CO-ORDINATION OF RATED VALUES FOR RATED VOLTAGES 123 kV AND ABOVE

(*Clause* 6.1)

Rated Voltage	Rated Short-Time Withstand Current	Rated Peak Withstand Current	Rated Normal Current					
kV	kA (rms)	kA	A (rms)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
123	12·5	32	800	1 250	—	—	—	—
	20	50	—	1 250	1 600	2 000	—	—
	25	63	—	1 250	1 600	2 000	—	—
	40	100	—	—	1 600	2 000	—	—
145	12·5	32	800	1 250	—	—	—	—
	20	50	—	1 250	1 600	2 000	—	—
	25	63	—	1 250	1 600	2 000	—	—
	31·5	80	—	1 250	1 600	2 000	3 150	—
	40	100	—	—	1 600	2 000	3 150	—
	50	125		—	—	2 000	3 150	—
245	20	50	—	1 250	1 600	2 000	—	—
	31·5	80	—	1 250	1 600	2 000	—	—
	40	100	—	—	1 600	2 000	3 150	—
	50	125	—	—	—	2 000	3 150	—
420	20	50	—	—	1 600	2 000	—	—
	31·5	80	—	—	1 600	2 000	—	—
	40	100	—	—	1 600	2 000	3 150	—
	50	125	—	—	—	2 000	3 150	4 000

APPENDIX A

(*Clause* 0.7)

COMPARISON WITH CORRESPONDING IEC PUBLICATION

A-0. This Indian Standard corresponds appreciably with the IEC Publication referred to in **0.6** except for the deviations listed below:

Clause 3.1 — Only those rated values which are applicable to the Indian conditions have been retained in this standard. This has necessitated consequential changes in the text and accordingly Tables 1, 2, 3, 5, 6, 11 and 12 have been drafted. For the purposes of guidance on other internationally accepted rated values, reference shall be made to IEC Publication mentioned in **0.6**.

Clause 3.3 — The rated frequency of disconnector (isolator) or earthing switches, for the purposes of this standard is defined as 50 Hz. For guidance on equipment meant for 60 Hz, reference shall be made to the IEC Publication mentioned in **0.6**.

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